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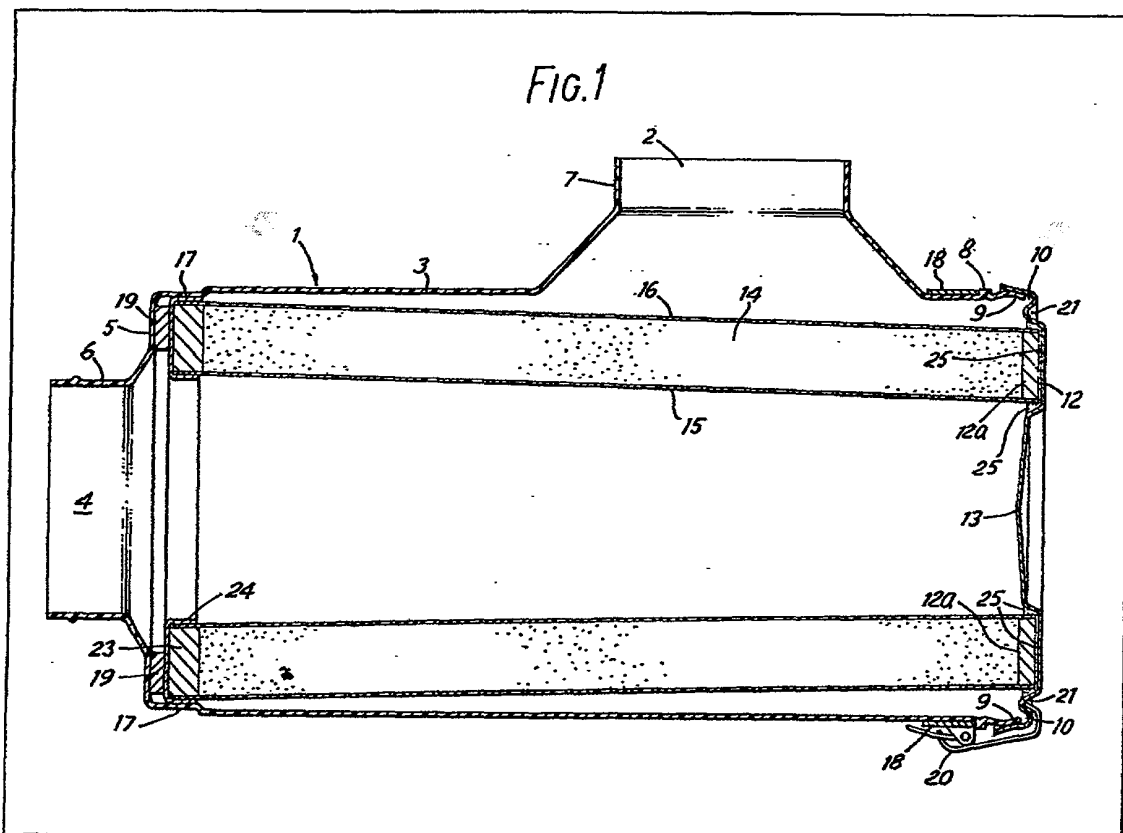
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(54) Air cleaner

(57) An air cleaner comprises an integrally formed generally tubular plastics body portion 1 having a radial (or tangential) opening 2 formed in the cylindrical wall thereof and an axial opening 4 in an end wall 5 thereof. The casing is open at the opposite end and has in the vicinity of said open

end an integral annular flange 8 which serves to retain on the casing a metal mounting band 18 encircling the latter. A closure 12, 13 for said open end comprises an integral cover and end cap for a filter element 15 in said casing, together with retaining means 20 associated with said mounting band 18 and closure whereby, in use, the closure is retained in place on the casing.

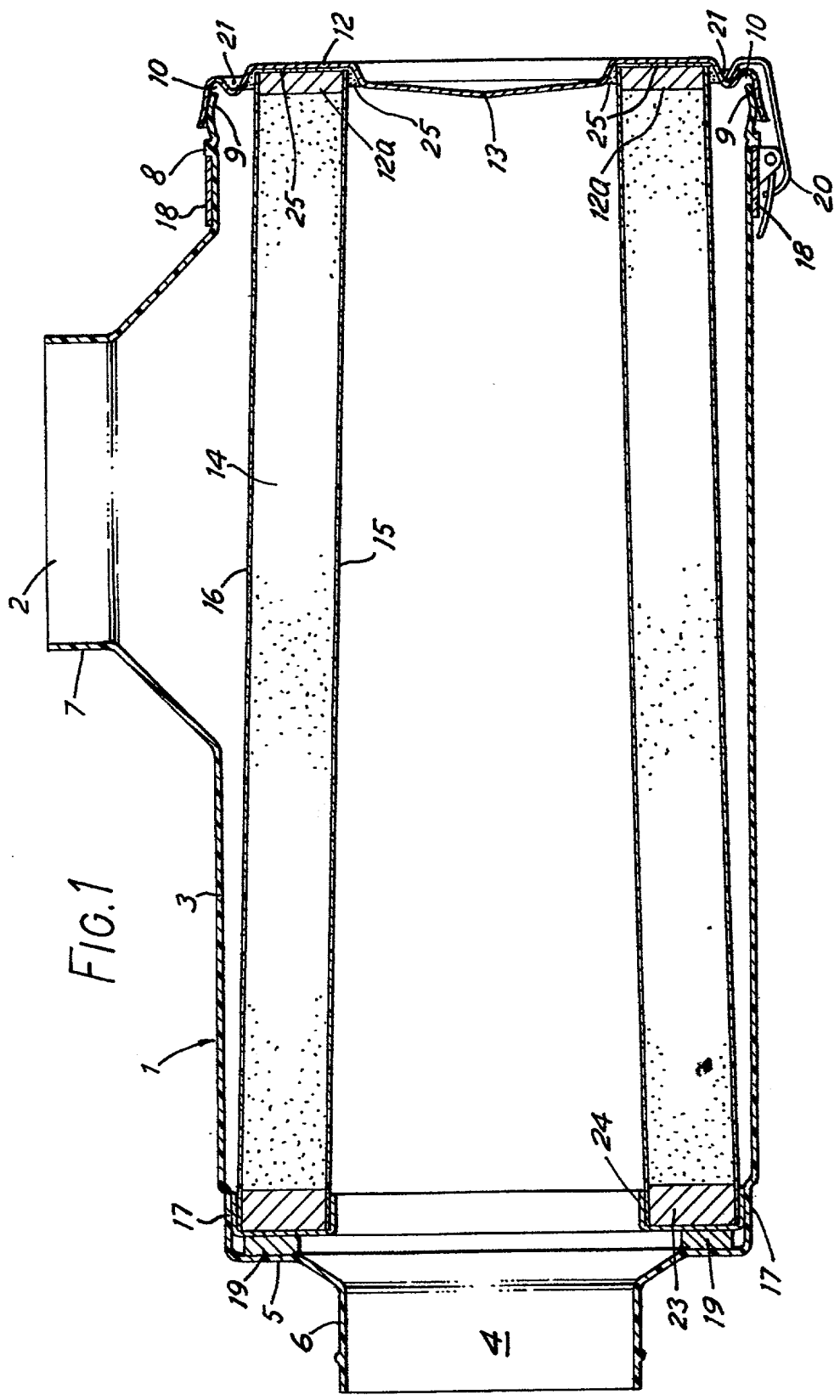
The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.



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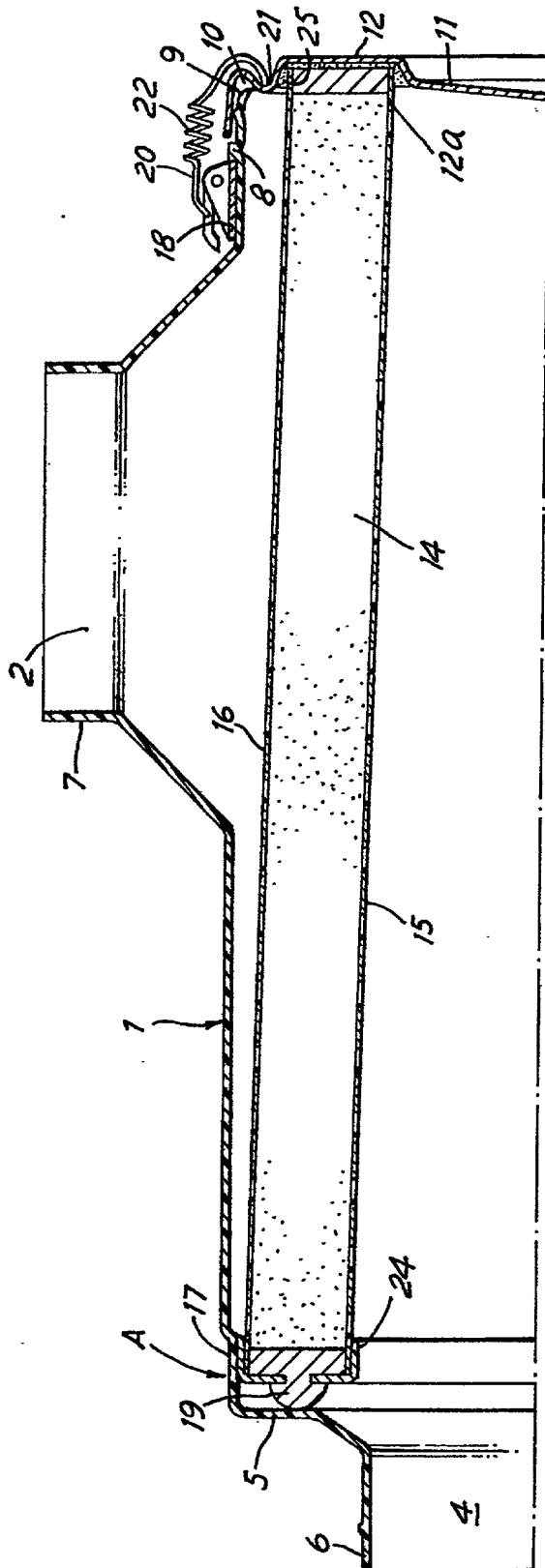


FIG. 2



FIG. 3

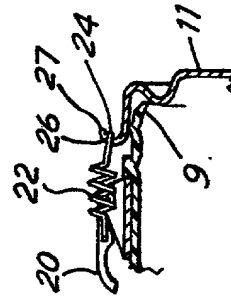


FIG. 4

SPECIFICATION

Improvements in and relating to air cleaners

This invention relates to filters, particularly for automotive use.

- 5 Automotive air cleaners comprise a casing having an inlet, an outlet and a filter element mounted inside the casing so that air flowing from inlet to outlet is constrained to pass through the filter element. The larger sizes of cleaner used for
10 heavy duty applications such as trucks and buses, or off-highway earth moving machines usually employ a divisible metal casing. Car cleaners are much smaller and may use either plastics or metal casings. However, it has proved difficult to adapt
15 plastics casings to heavy duty cleaners.

- The lack of strength and/or rigidity of plastics materials makes it impracticable to simply reproduce a relatively large divisible metal casing in plastics. To impart sufficient structural strength
20 it has proved necessary to reinforce the plastics casing by such expedients as significantly increasing the wall thickness and introducing stiffening ribs; both of these add to the cost, as well as making manufacture undesirably
25 expensive. In particular, the tooling costs for an injection moulded plastic casing can be extremely high where it is necessary to provide extensive stiffening ribs and reinforcements as well as providing for division to install/remove a filter
30 element. Further problems arise in fastening halves of the body together as well as in fastening the whole cleaner to a vehicle so that the plastic cleaner body is not over-stressed.

- According to the present invention, an air
35 cleaner comprises an integrally formed generally tubular plastics body portion having a radial or tangential opening formed in the cylindrical wall thereof and an axial opening in an end wall
40 thereof, the casing being open at the opposite end and having in the vicinity of said open end an integral external annular flange which serves to retain on the casing a metal mounting band encircling the latter, a closure for said open end,
45 the closure means comprising an integral cover and end cap for a filter element in said casing, together with retaining means associated with said mounting band and closure whereby, in use, the closure is retained in place on the casing.

- Preferably, the closure is integrally formed from
50 metal and has a recess or abutment for receiving clip means associated with the mounting band. The well-known "over-centre" clips are particularly preferred, although other types of retaining means can be used.

- 55 Because plastics materials tend to have very much higher coefficients of thermal expansion than do metals, the tubular plastics body portion is likely to expand longitudinally appreciably more than the filter element inside it. For this reason, it
60 is preferred that the retaining means should be capable of maintaining a seal at both ends of the filter element under all normal service conditions, to avoid leakage around the filter. Retaining means incorporating springs are particularly

- 65 preferred for this.

- Because the metal mounting band simply encircles the casing and because an annular plastic flange is provided to retain the band on the casing, the stresses due to the action of the over-
70 centre clips and to the attachment of the band to a vehicle are transferred uniformly to the full circumference of the casing, rather than being localised in any particular part of it. More important, the stresses tend to put the plastics
75 material into compression rather than tension; the metal band alone is subjected to the stresses caused by bolting to a vehicle body. The band can, of course, be made quite wide, so that no part of the plastics material has to bear more than a safe
80 proportion of the load. Furthermore, the use of an integral metal cover and end cap for the filter element means that the open end of the casing can be reinforced by the closure whilst at the same time eliminating the need for a separate end
85 cap for the filter element and also the need for separate filter retaining means inside the casing. It is not even essential to seal the filter end to the abutting face of the end cap by means of the usual resilient gasket. In fact, there are advantages in
90 not doing this because most if not the whole of the sealing pressure developed between the end cap and filter element can be transferred to the opposite end of the element adjacent the axial opening in the casing, thereby enhancing the seal
95 in this region.

- Where the tapered conical element principle of our UK patent No. 1507824 is adopted, the foregoing arrangements offer further advantages. The outside diameter of the relatively wide end of
100 a conical element can be made large enough to form an interference fit with the casing around the axial opening. The latter can be enlarged up to the full internal diameter of the filter element at said wide end, thereby very significantly reducing the
105 pressure drop across the filter in comparison to that which could be achieved in the same diameter of casing with a conventional cylindrical element. Preferably, the casing wall in the vicinity of the end wall containing the axial opening is
110 shaped to provide the desired interference fit; this also provides a self-centering means for the filter element. This avoids the use of any ancillary guide the inside of associated with the opening.

- It will be noted that the invention as thus far described comprises a simple plastics casing which can be made, for example, by blow
115 moulding without the need for very expensive and/or complicated tooling. In order that the invention be better understood a preferred
120 embodiment of it will now be described by way of example with reference to the accompanying drawing, in which:—

- Figure 1 is a cross-sectional side view of a filter casing and closure in accordance with the
125 invention.

Figure 2 is a cross-sectional side view of another filter casing and closure in accordance with the invention,

Figure 3 is a cross-sectional end view of that

part of the casing designated A in Figures 1 and 2, and

Figure 4 is a cross-sectional view of the portion B of Figure 3, showing a modification thereof.

5 Like parts in all four Figures have like reference numerals, in the interests of clarity. It will be appreciated that in Figure 2, only half of the casing is shown, the cut-away portion being generally as in Figure 1.

10 In Figures 1 and 2 a generally cylindrical integrally formed plastic casing has a radially directed opening 2 formed in the cylindrical wall 3 and an axial opening 4 formed in the end wall 5. Both openings are profiled to provide tubular extensions 6 and 7 respectively for connecting the casing to ancillary pipework (not shown).

The casing is open at the opposite end and has an integrally formed external annular plastic flange 8 around it adjacent the open end. The margins of the latter are slightly chamfered at 9 to fit snugly into an annular recess 10 formed in a metal closure 11 for the open end of the casing. The closure 11 has a central area provided with an annular flat-bottomed recess 12 surrounding a central dished area 13. The recess 12 is configured to receive the end of frusto-conical pleated paper filter element installed in the casing.

The closure constitutes an end cap for the smaller diameter end 12a of the filter element, which comprises a pleated paper filter medium 14 located between perforated inner and outer metal supports 15, 16. The wider diameter end is fitted with an annular end cap 24 provided with a resilient gasket 19; this wider end of the filter element is an interference fit inside the casing around the margin of the opening 4. The casing has shaped wall portions 17 to ensure this close fit. This is better seen in figure 2 at A, as well as in figure 3 where A is shown as viewed in section from one end of the casing. The element is centred relative to the opening 4 by virtue of the interference fit; it is centred at the opposite end by the recess 12 and the engagement of the casing chamfered region 9 in the recess 10. It should be noted that the end 12a of the filter element is sealed to the closure 12 by an adhesive composition, 25.

The filter is provided with a metal mounting band 18 which is firmly clamped around the casing in abutting relation to the flange 8. The band is provided with a plurality of equally spaced over-centre clips 20. These have terminal hooked portions which serve to retain the closure by engagement with an annular recess 21 formed in the closure radially inwardly of the oppositely directed recess 10. It should be noted that because the closure also acts as an end cap for the filter element, it is not necessary to provide a separate end cap as part of the end of the element.

Referring now to Figure 3, the interference fit described earlier is shown in end section. It takes the form of a number (three in this instance) equally-spaced flats 17 integrally moulded into the casing, towards the left-hand end thereof (in Figures 1 and 2).

Referring now to figures 2 and 4, a modified form of retaining means is shown. In Figure 2, the recess 21 in the closure 12 co-operates with an over-centre clip 20 which incorporates a spring 22. This compensates for longitudinal expansion of the casing 1 at elevated temperatures, by maintaining pressure on the gasket 19, through the adhesive 25, the filter element walls 15, 16 and the end cap 24.

Figure 4 shows a slightly different type of over-centre clip. This also includes a spring 22, and terminates in a hook portion 24. This is received in a notch 26 formed in the rim 27 of the closure 12. This particular embodiment requires that the closure 12 be provided with a somewhat different rim profile, incorporating the necessary notches. It also requires that the closure be correctly oriented relative to the casing so that the hook portions and notches are aligned. However, it provides a neater assembly.

CLAIMS

1. An air cleaner comprising an integrally formed generally tubular plastics body portion having a radial or tangential opening formed in the cylindrical wall thereof and an axial opening in an end wall thereof, the casing being open at the opposite end and having in the vicinity of said open end an integral external annular flange which serves to retain on the casing a metal mounting band encircling the latter, a closure for said open end, the closure means comprising an integral cover and end cap for a filter element in said casing, together with retaining means associated with said mounting band and closure whereby, in use, the closure is retained in place on the casing.

2. An air cleaner according to claim 1 wherein the closure is integrally formed from metal and has a recess or abutment for engagement by the retaining means.

3. An air cleaner according to claim 2 wherein the retaining means is an over centre clip.

4. An air cleaner according to any preceding claim wherein the retaining means incorporates a resilient portion to compensate for differential thermal expansion of the casing and filter element.

5. An air cleaner according to claim 4 wherein the resilient portion includes a spring.

6. An air cleaner according to any preceding claim wherein the closure constitutes an end cap for the filter element and is adhered thereto.

7. An air cleaner substantially as described with reference to and as illustrated by the accompanying drawings.